

WHAT IS CLAIMED IS:

1. An electric network simulating method comprising the steps of:

5 defining element cells representing electric functions of a plurality of circuit elements and connection pipes representing wiring lines for connecting the circuit elements, defining an electric network current as the number of particles moving in the connection pipe per unit time, and defining an
10 electric network voltage as the number of particles present in the connection pipe;

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15 on the basis of definitions in the defining step, setting beforehand, in units of element cells, a rule for expressing an electric function of each of the circuit elements in accordance with a state of the connection pipe connected to each of the element cells;

transferring particles between the element cell and the connection pipe in accordance with the set rule; and

20 simulating the state of the electric network by updating the number of particles passing through a given connection pipe per unit time in the transferring step and the number of particles present in the given connection pipe, and performing transfer and updating
25 processes at least once.

2. An electric network simulating method comprising the steps of:

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5. An electric network simulating method

according to one of claims 1 and 2, wherein the
defining step includes the step of

when a given one of the element cells has
nonlinearity as a function of time, defining the given
circuit element as a combination of an element cell
for a resistive element and one of an element cell
expressing a current source and an element cell
expressing a voltage source, the combination expresses
linearity equivalent to a behavior of the given circuit
element at given time; and

the setting step includes the steps of

when a certain one of the circuit elements is
a current source, setting a rule for extracting the
number of particles corresponding to a current value
per unit time from one of two connection pipes
connected to an element cell expressing the certain
circuit element and giving the number of particles
equal in number to the number of extracted particles
to the other one of the two connection pipes, and

when a specific one of the circuit elements is a
voltage source, setting a rule for making a difference
between the number of particles in one of two connec-
tion pipes connected to an element cell expressing the
specific circuit element and the number of particles in
the other one of the two connection pipes equal to the
number of particles corresponding to a voltage of the
voltage source.

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6. An electric network simulating method according to one of claims 1 and 2, wherein the setting step includes the step of

when a given one of the circuit elements has an impedance characteristic discontinuously changing, preparing a plurality of rules for the element cell for expressing the given circuit element and selecting one of the plurality of rules in accordance with the state of the connection pipe connected to the element cell.

7. An electric network simulating method according to claim 5, wherein the transferring step and the simulating step include the step of

simulating the state of each element cell at initial time so as to simulate a transient phenomenon of the given circuit element having nonlinearity as a function of time, simulating a behavior of the nonlinear element at an operating point advancing by a shortest time interval, by changing each parameter of a combination of the element cells having functions equivalent to the element cells, and simulating the transient phenomenon by repeating the change in parameter every time the shortest time interval has elapsed.

8. An electric network simulating method according to claim 6, wherein the transferring step and the simulating step include the step of simulating a behavior of each element cell at

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12. An electric network simulating apparatus according to one of claims 9 and 10, wherein the

setting means includes

means for setting, when a given one of the circuit elements is a voltage source, a rule for making a difference between the number of particles in one of two connection pipes connected to an element cell expressing the given circuit element and the number of particles in the other one of the two connection pipes equal to the number of particles corresponding to a voltage of the voltage source.

13. An electric network simulating method according to one of claims 9 and 10, wherein the defining means includes

means for defining, when a given one of the element cells has nonlinearity as a function of time, the given circuit element as a combination of an element cell for a resistive element and one of an element cell expressing a current source and an element cell expressing a voltage source, the combination expresses linearity equivalent to a behavior of the given circuit element at given time, and

the setting means includes

means for setting, when a certain one of the circuit elements is a current source, a rule for extracting the number of particles corresponding to a current value per unit time from one of two connection pipes connected to an element cell expressing the certain circuit element and giving the number of

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means for defining element cells representing

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means for, after setting element cells representing electric functions of a plurality of circuit



20 means for transferring particles between the element cell and the connection pipe and between the intersection cell and the connection pipe on the basis of the rules set in the setting step; and

means for simulating the state of the electric network by updating the number of particles passing through a given connection pipe per unit time and the number of particles present in the given connection

pipe in the transferring means and performing transfer and updating processes at least once.

19. A storage medium storing the simulation program according to one of claims 17 and 18, wherein the setting means includes

means for setting, when a given one of the circuit elements is a current source, a rule for extracting the number of particles corresponding to a current value per unit time from one of two connection pipes connected to an element cell expressing the given circuit element and giving the number of particles equal in number to the number of extracted particles to the other one of the two connection pipes.

20. A storage medium storing the simulation program according to one of claims 17 and 18, wherein the setting means includes

means for setting, when a given one of the circuit elements is a voltage source, a rule for making a difference between the number of particles in one of two connection pipes connected to an element cell expressing the given circuit element and the number of particles in the other one of the two connection pipes equal to the number of particles corresponding to a voltage of the voltage source.

21. A storage medium storing the simulation program according to one of claims 17 and 18, wherein the defining means includes

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means for defining, when a given one of the
element cells has nonlinearity as a function of time,
the given circuit element as a combination of an
element cell for a resistive element and one of an
5 element cell expressing a current source and an element
cell expressing a voltage source, the combination
expresses linearity equivalent to a behavior of the
given circuit element at given time; and

the setting means includes

10 means for setting, when a certain one of the
circuit elements is a current source, a rule for
extracting the number of particles corresponding to a
current value per unit time from one of two connection
pipes connected to an element cell expressing the
15 certain circuit element and giving the number of
particles equal in number to the number of extracted
particles to the other one of the two connection pipes,
and

20 means for setting, when a specific one of the
circuit elements is a voltage source, a rule for making
a difference between the number of particles in one
of two connection pipes connected to an element cell
expressing the specific circuit element and the number
of particles in the other one of the two connection
25 pipes equal to the number of particles corresponding to
a voltage of the voltage source.

22. A storage medium storing the simulation

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program according to one of claims 17 and 18, wherein the setting means includes

means for, when a given one of the circuit elements has an impedance characteristic discontinuously changing, preparing a plurality of rules for the element cell for expressing the given circuit element and selecting one of the plurality of rules in accordance with the state of the connection pipe connected to the element cell.

23. A storage medium storing the simulation program according to claim 22, wherein the transferring means and the simulating means include

means for simulating the state of each element cell at initial time so as to simulate a transient phenomenon of the given circuit element having nonlinearity as a function of time, simulating a behavior of the nonlinear element at an operating point advancing by a shortest time interval, by changing each parameter of a combination of the element cells having functions equivalent to the element cells, and simulating the transient phenomenon by repeating the change in parameter every time the shortest time interval has elapsed.

24. A storage medium storing the simulation program according to claim 23, wherein the transferring means and the simulating means include

means for simulating a behavior of each element

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simulating steps every time the shortest time interval
has elapsed.